



# UX in Space:

## How NASA's JPL is Adopting A User-Centered Design Approach

Krys Blackwood  
[@shodoshan](#)



**Jet Propulsion Laboratory**  
California Institute of Technology

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Government sponsorship acknowledged.

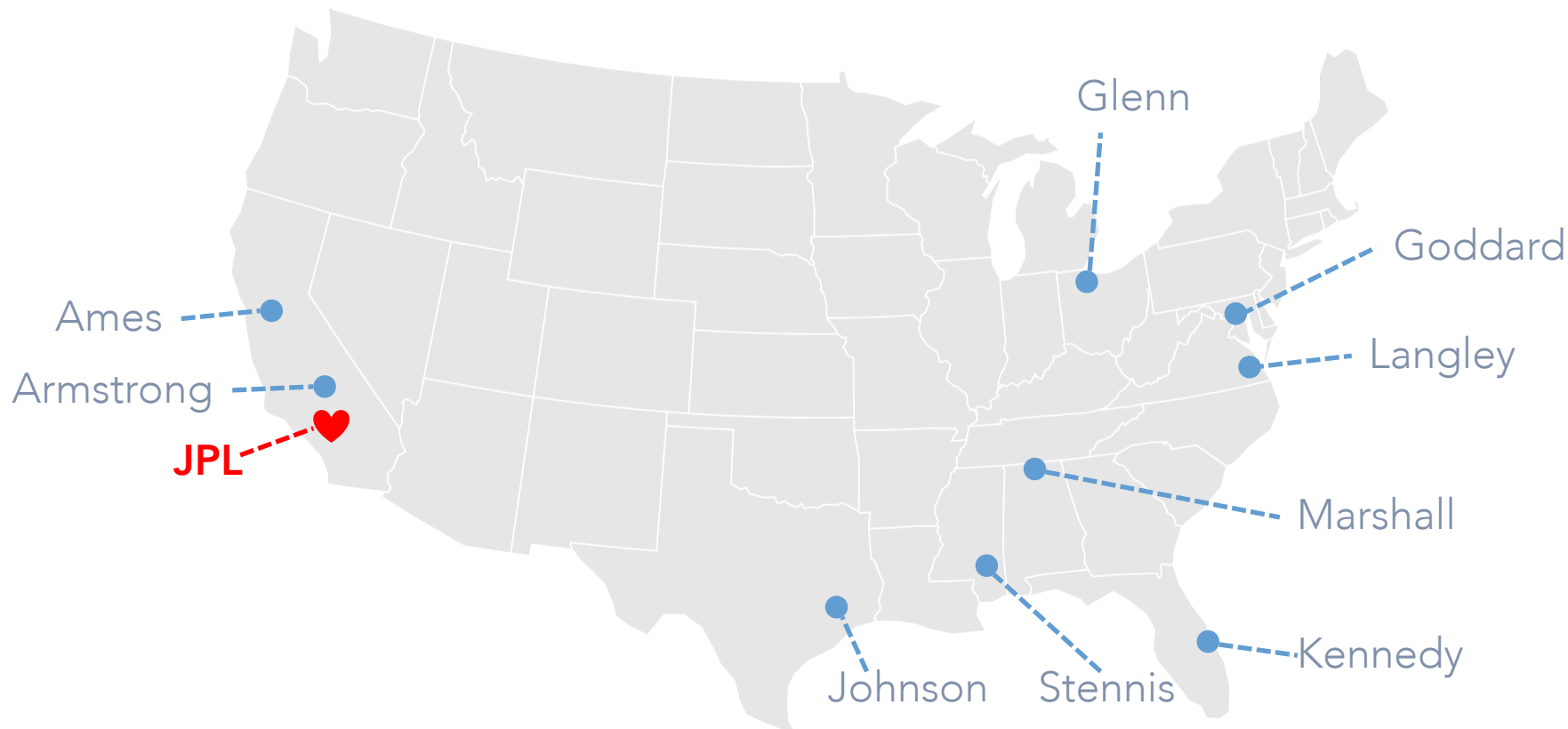


Image credit: <https://www.nasa.gov/feature/behind-the-space-shuttle-mission-numbering-system>



# NASA has a lot going on

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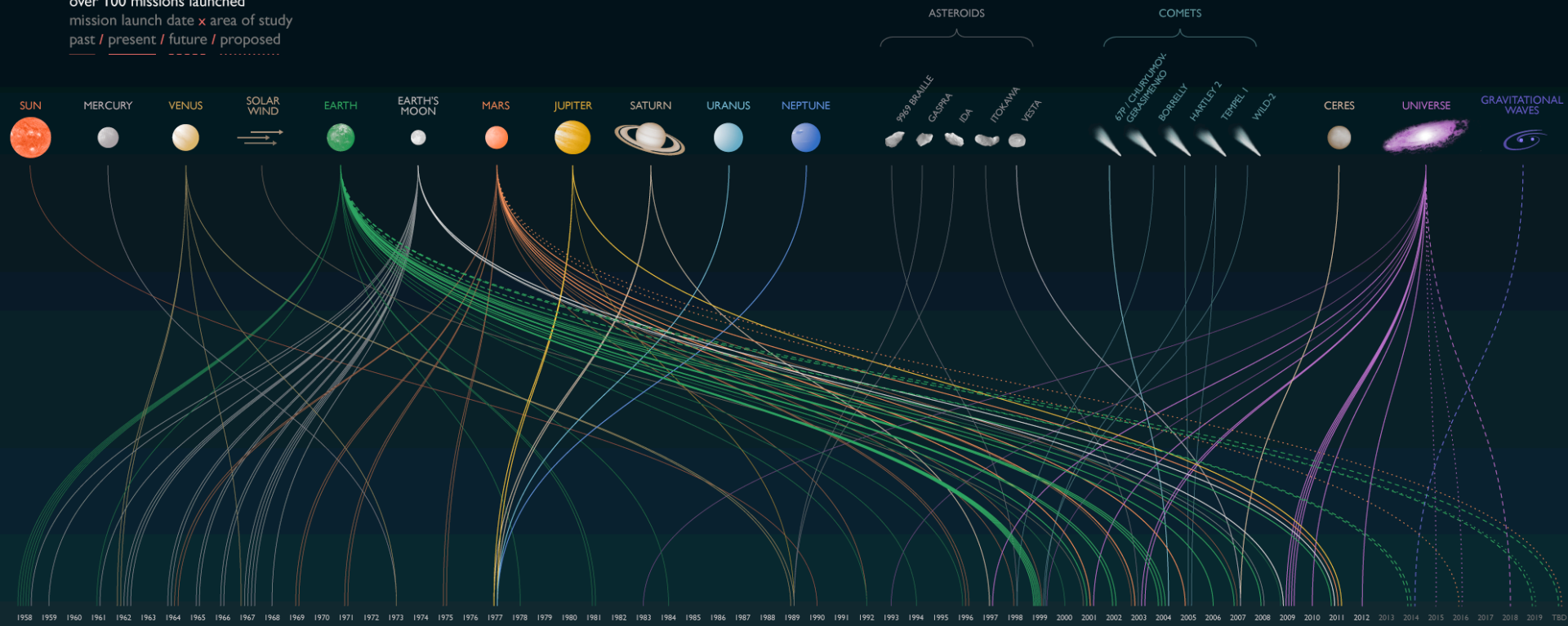
# 80 (+) years of awesome

## JPL MISSION HISTORY

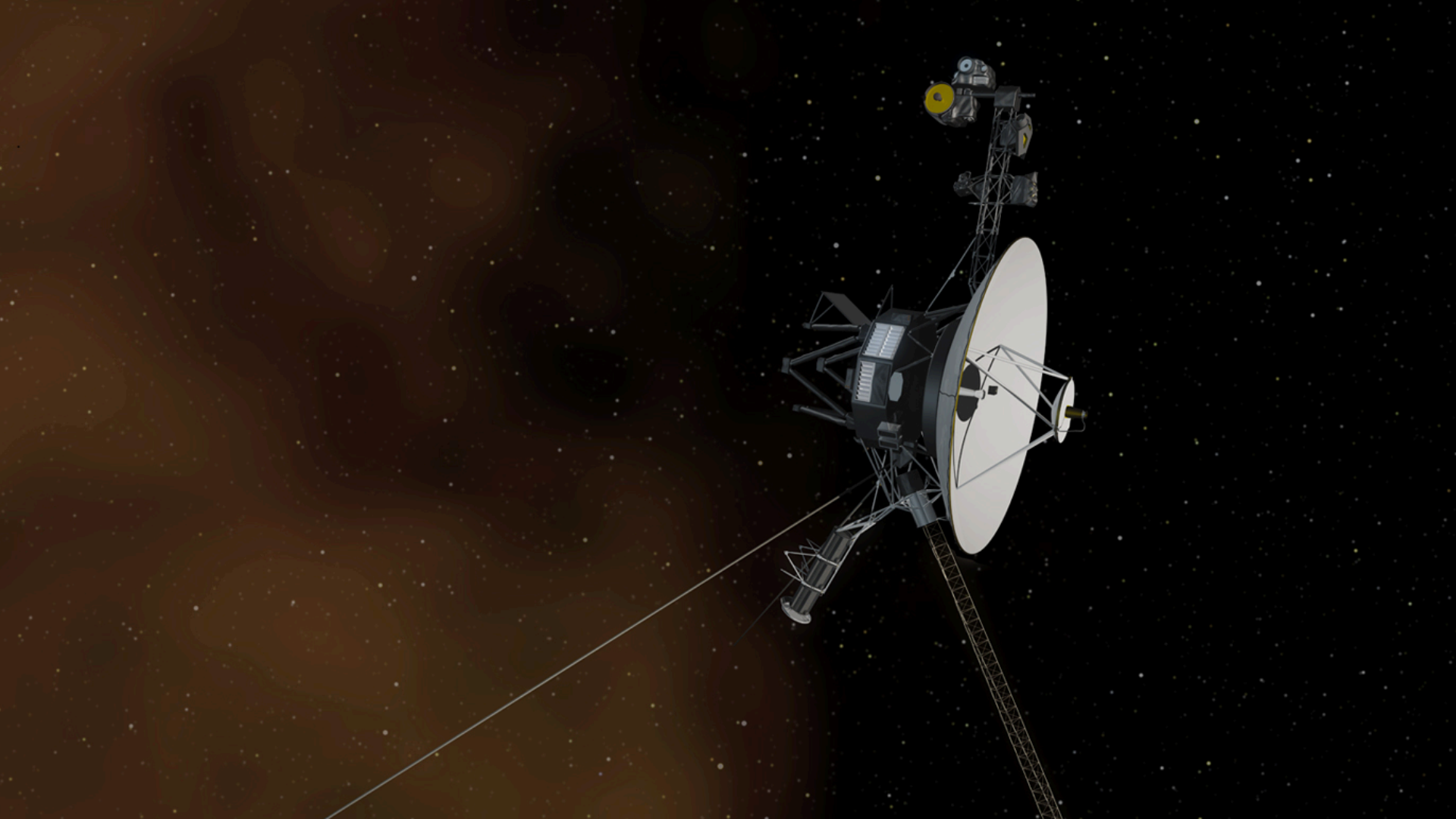
over 100 missions launched

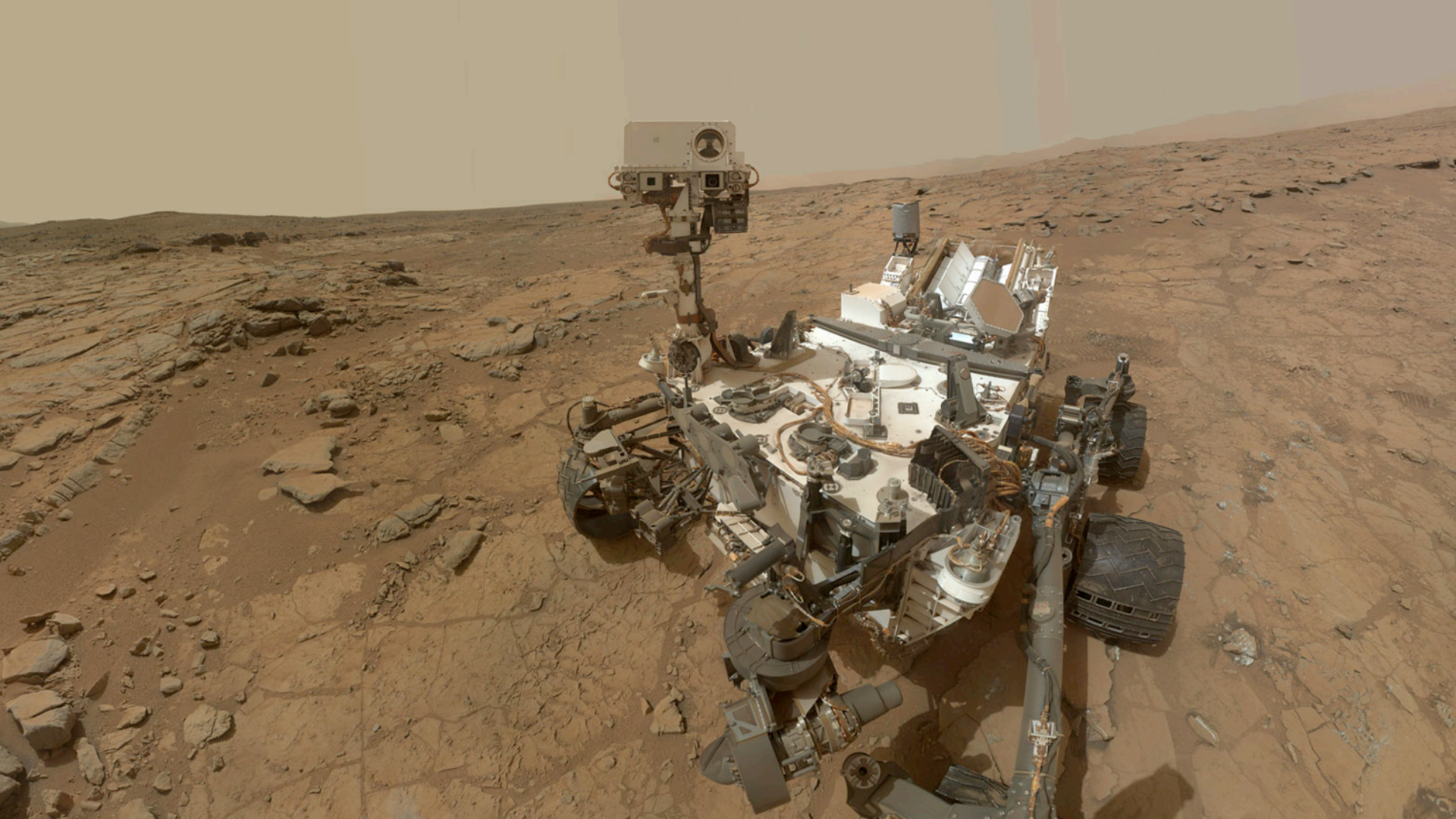
mission launch date x area of study

past / present / future / proposed

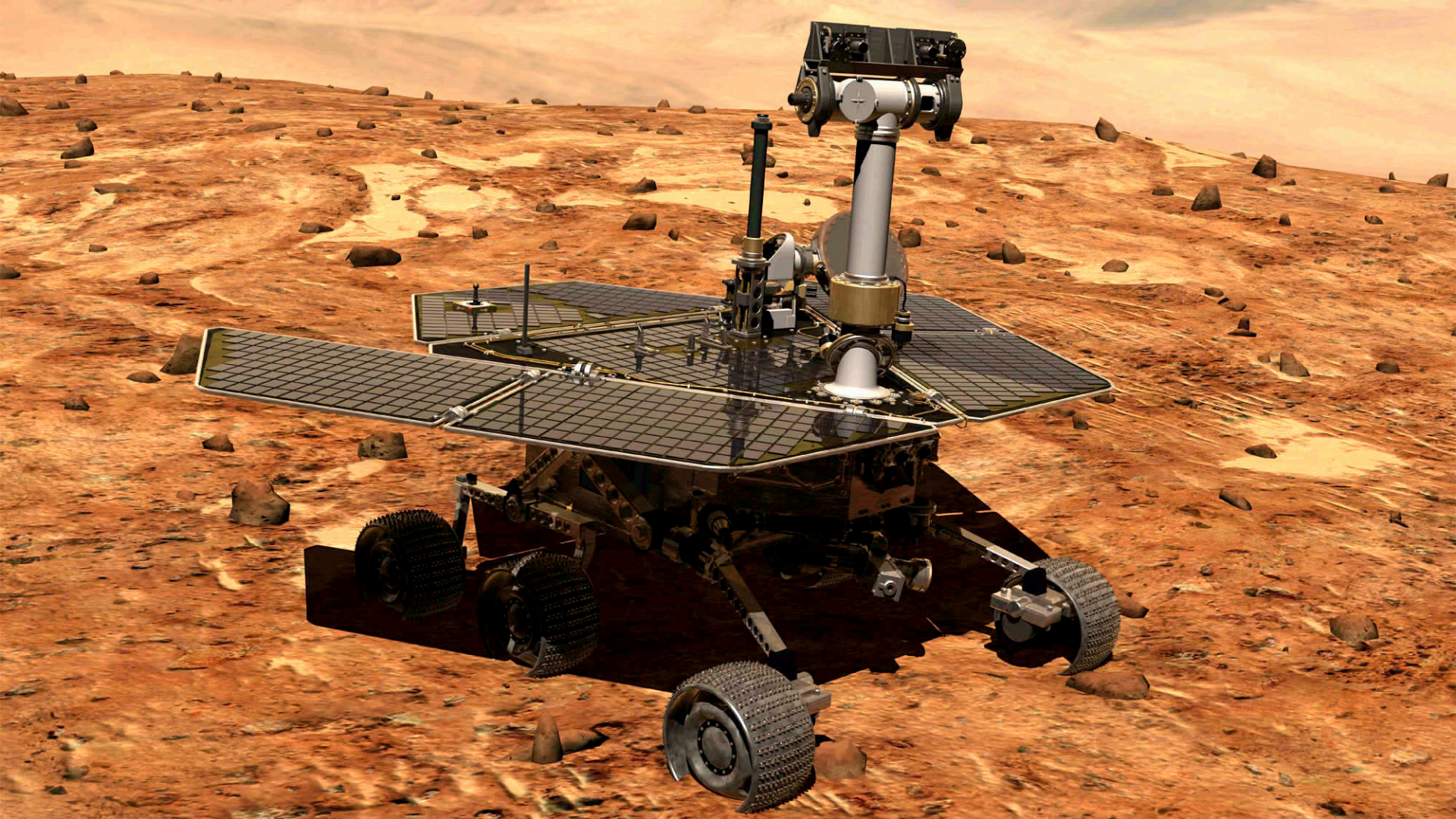


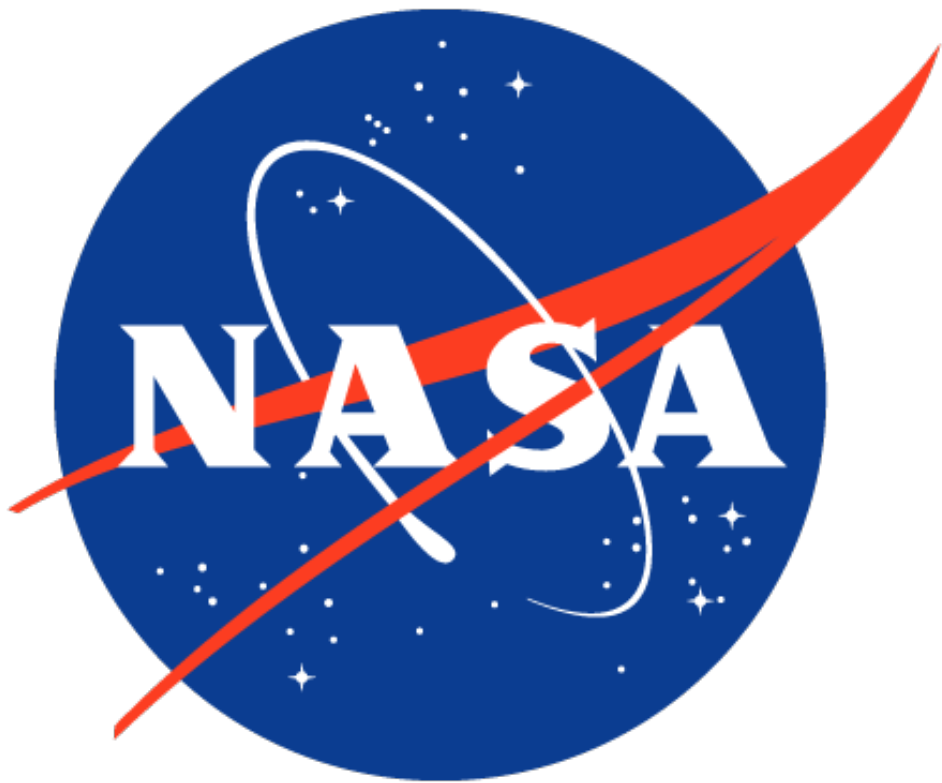












FAILURE  
**IS NOT**  
AN OPTION

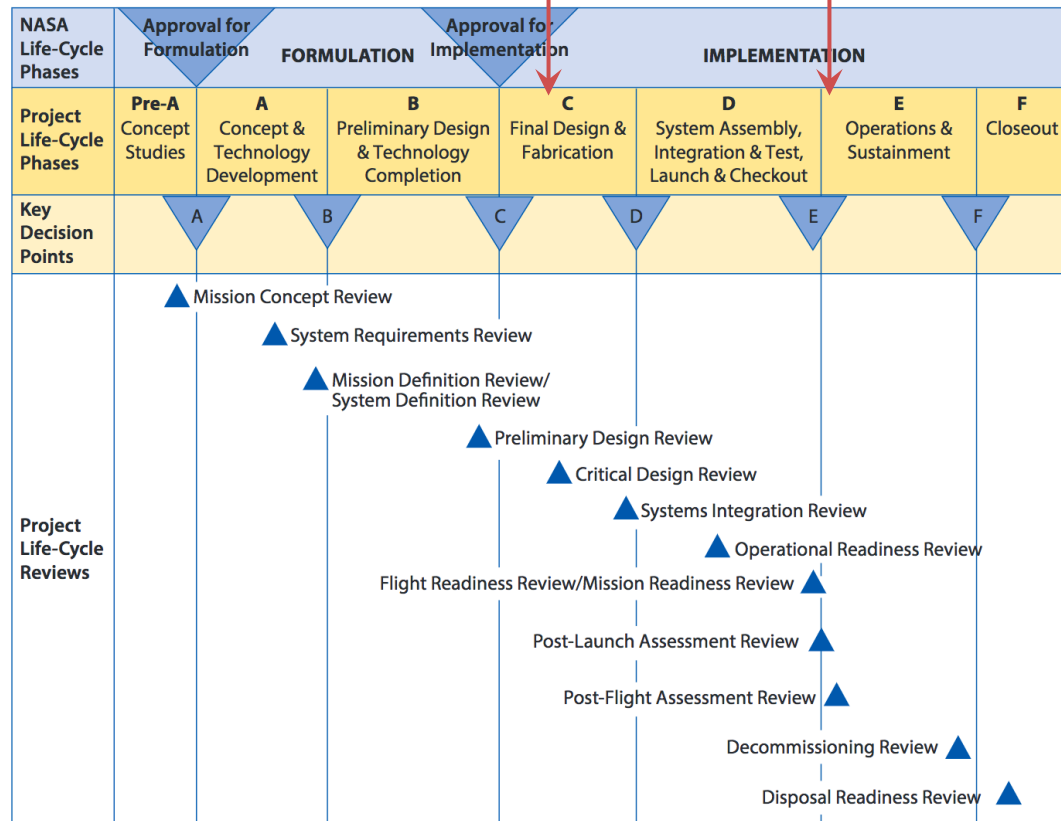


So how does it happen?



Designing human processes

Designing software





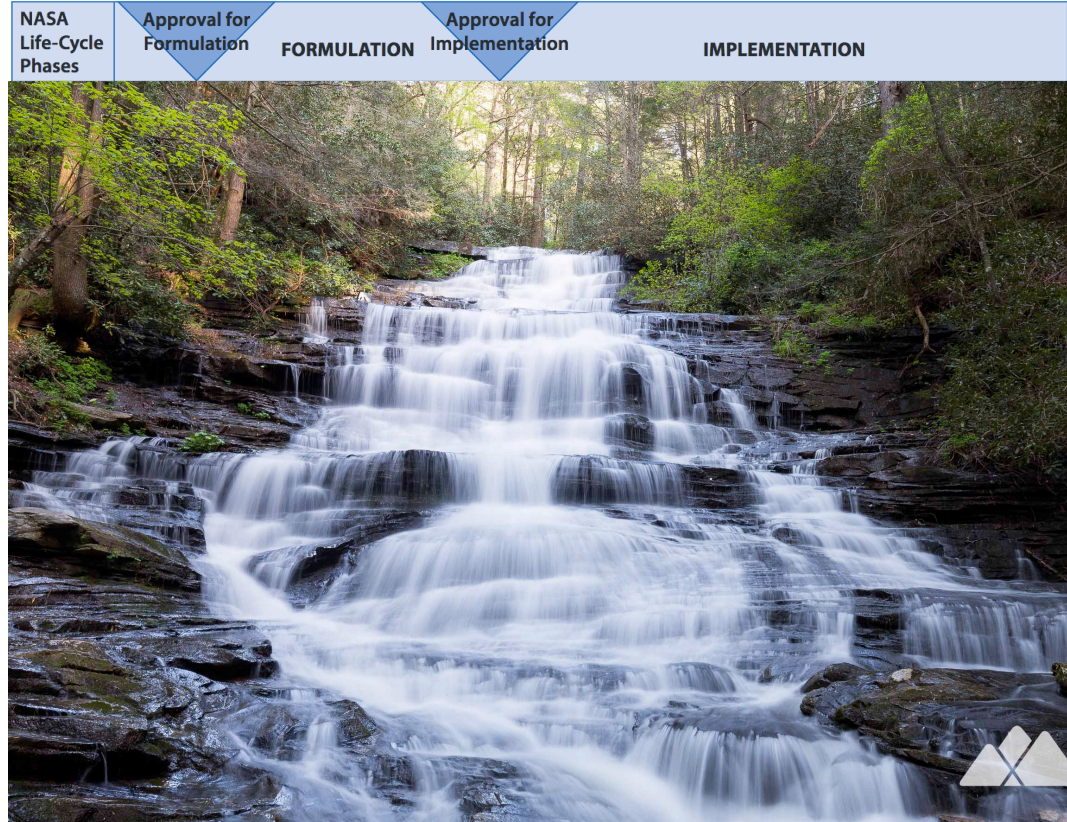


Image credit: <https://www.atlantatrails.com/blog/georgia-waterfall-road-trip/>

Everybody loves chevron diagrams, right?



```
graph LR; A[Concept] --> B[Formulation]; B --> C[Implementation]; C --> D[Operations]
```

Concept

Formulation

Implementation

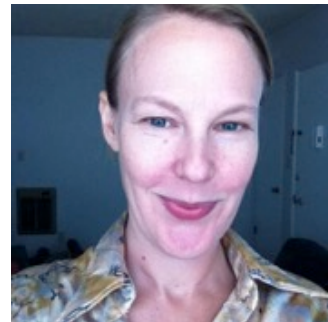
Operations

Human-centered design group



# Small but mighty

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# Case Study: Augmented Reality

# Mars is a Dangerous Place

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How steep is that hill?

How soft is that sand?

Is there a drop off on the other side of that ridge?

...and there's no AAA





Concept

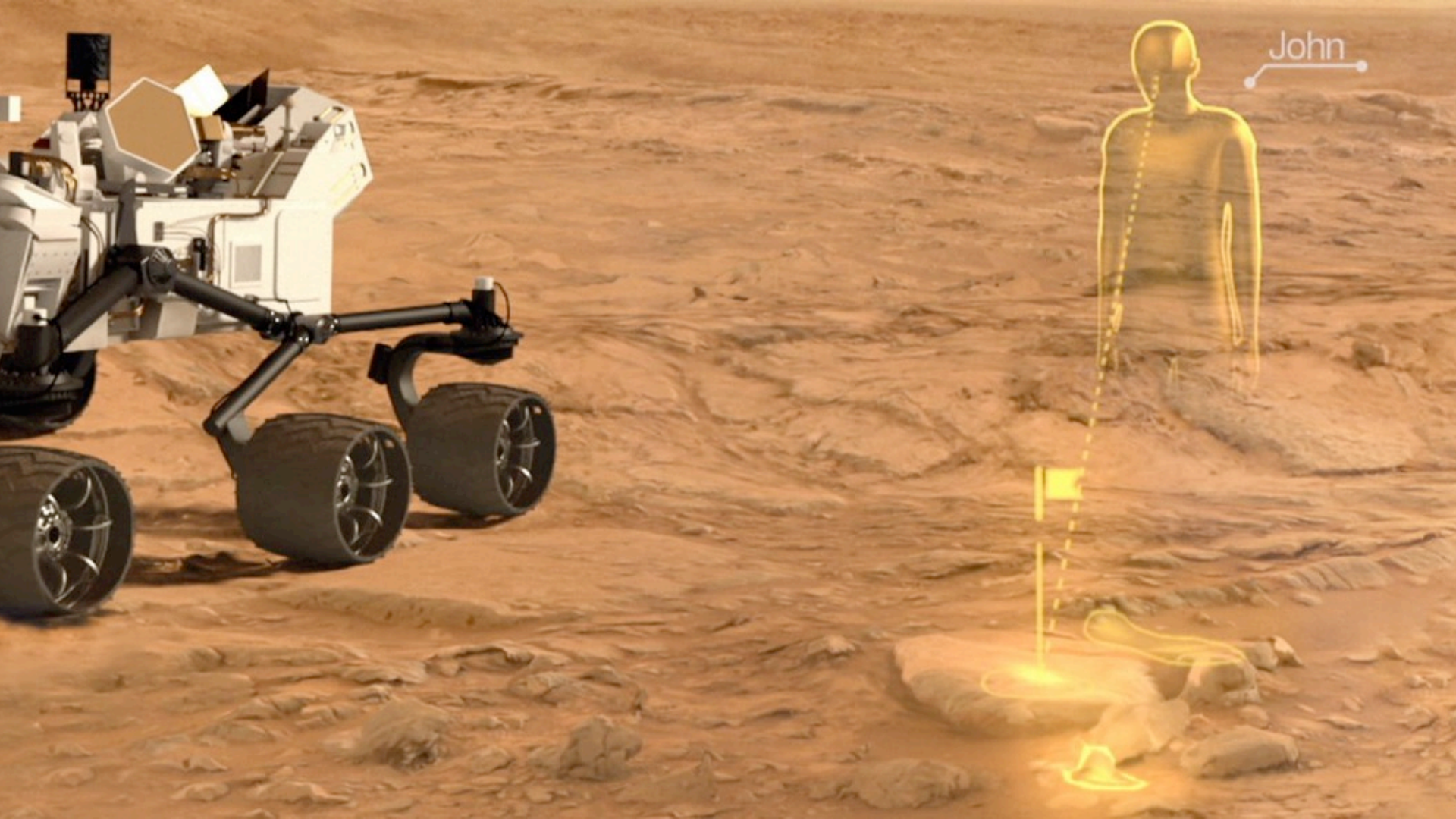
Formulation

Implementation

Operations







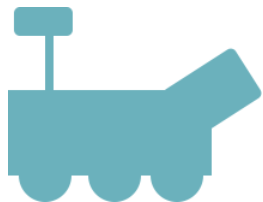
John





# Case Study: The Next Mars Mission

# Earlier than ever: Mars 2020



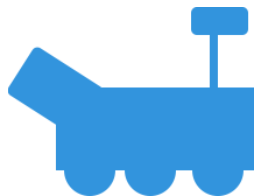
Curiosity (2011)



Planning



Driving & Science-y Stuff



New Rover (2020)



Planning



Driving & Science-y Stuff

More info: <https://aerospaceamerica.aiaa.org/features/beating-curiosity/>

Concept

Formulation

Implementation

Operations



How do you prove a concept five years before you get money to build the tools?

# Start small: Design sprints



# Not like project sprints

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Borrows a lot from Agile

Cross-functional teams, working one story from beginning to end in 5 days together:

- ★ Monday: Map out the problem, build common language
- ★ Tuesday: Solution brainstorm and sketches
- ★ Wednesday: Narrow down, make a test
- ★ Thursday: Prototype
- ★ Friday: Test!

More info: <http://www.gv.com/sprint/>



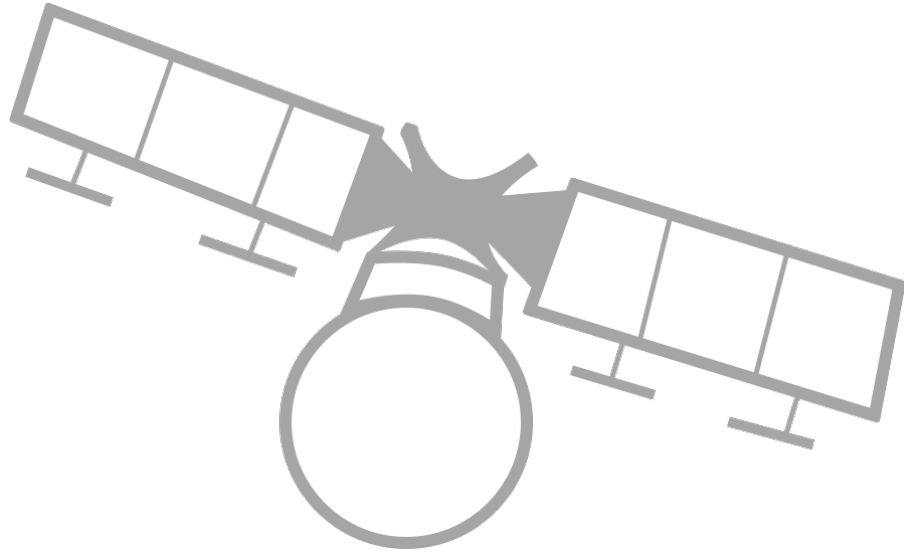
# Get bigger: Design simulations



## Case Study: Europeanauts

# Uncharted waters: Europa Clipper

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Searching for habitability

High-radiation environment

Small operations budget

Unique human-centered approach

Where no one has gone before

Concept

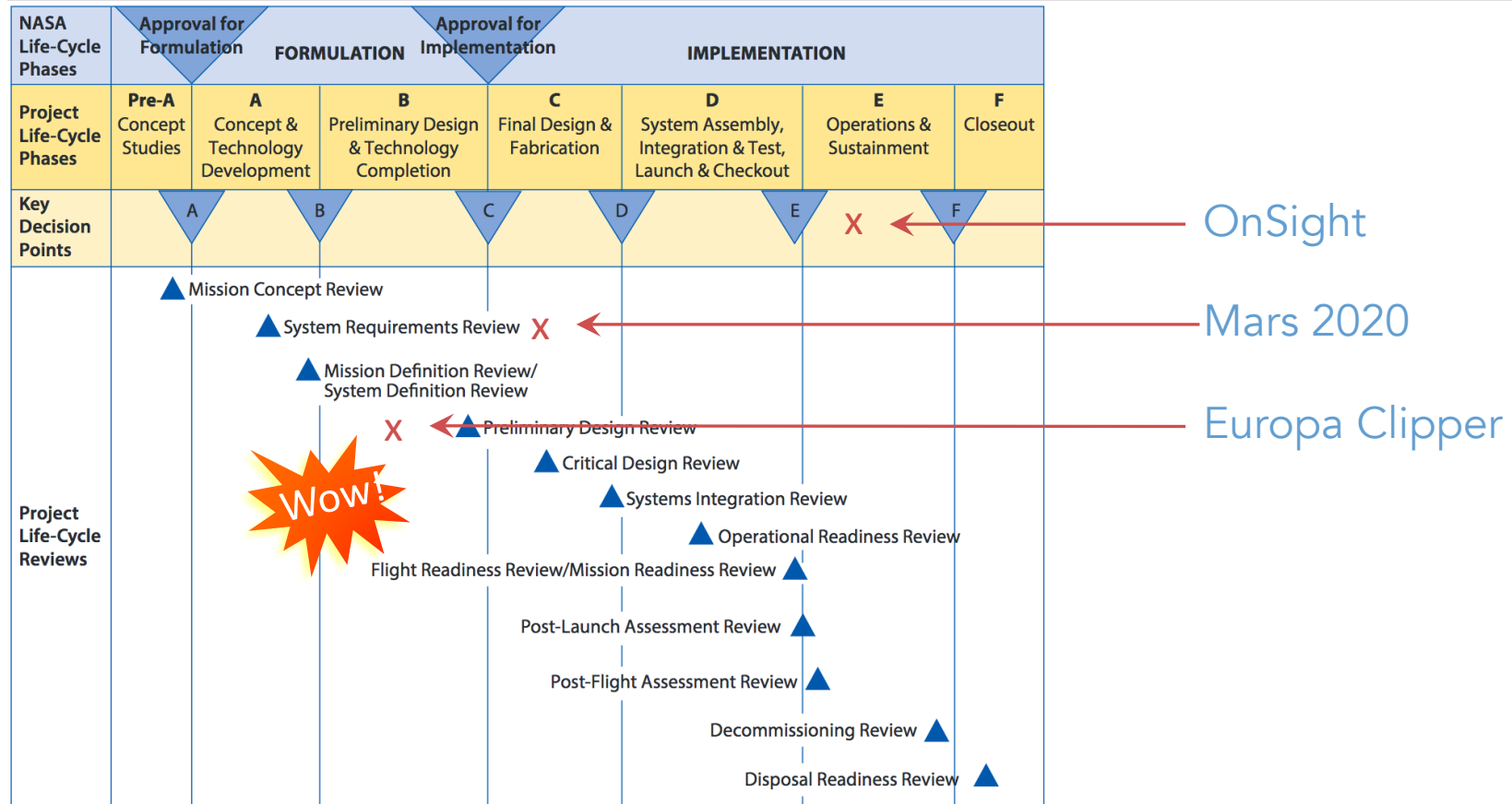
Formulation

Implementation

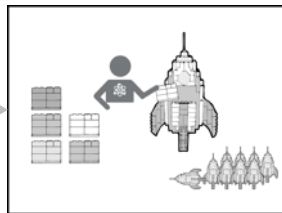
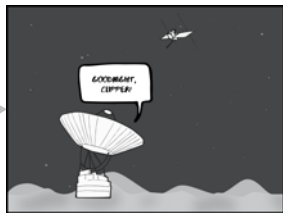
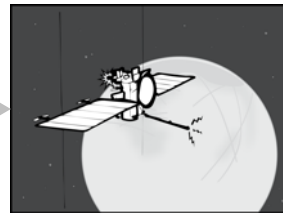
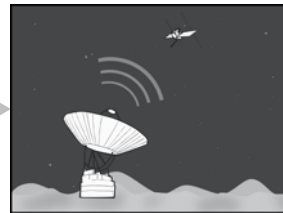
Operations



# The earliest



# Telling stories

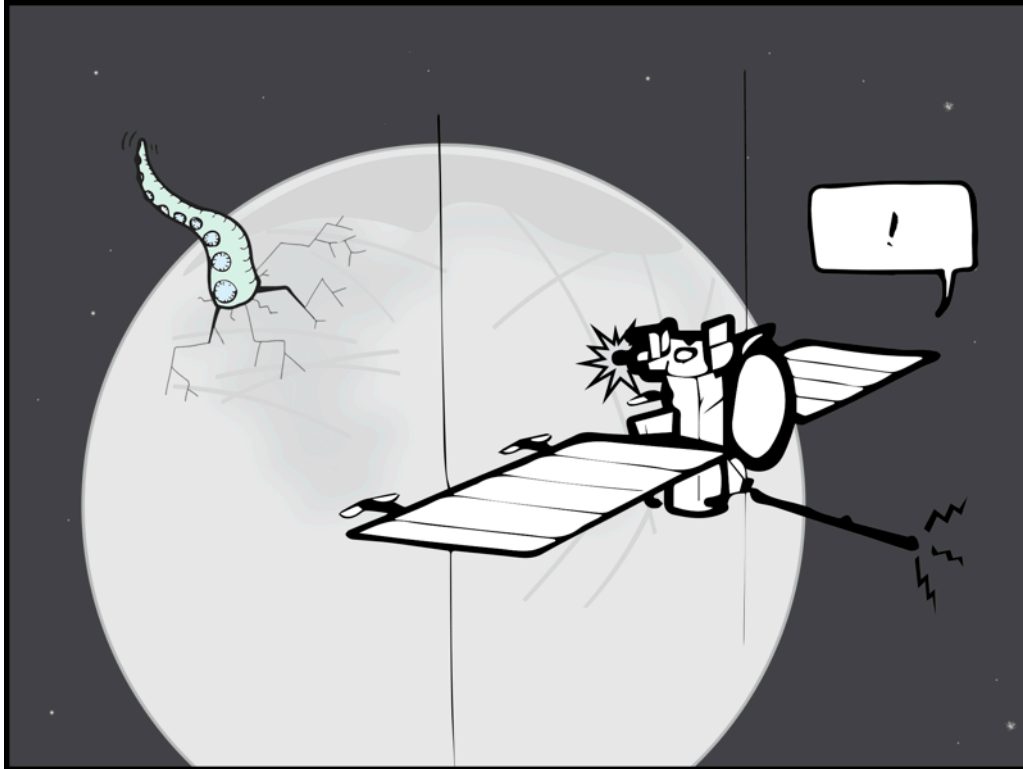


# Workshopping



# Planning for the unknown

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NO, we don't expect to see a tentacle...

But it's a good analogy.



# Agile before there's code

The image displays three sequential screenshots of the Jira Kanban board interface, illustrating the workflow stages and issue tracking.

**Top Screenshot: Workshop Parking Lot Kanban board**

- Navigation:** JIRA logo, Dashboards, Projects, Issues, Boards, Create button, Search bar, and utility icons.
- Board Title:** Workshop Parking Lot Kanban board.
- Quick Filters:** Only My Issues, Recently Updated.
- Columns:**
  - 13 To Do:** Contains issue MOS-38.
  - 11 In Progress:** Contains issue MOS-70.
  - 18 Ready for Closure:** Contains issue MOS-44. A "Release..." link is visible.

**Middle Screenshot: Design PDR Prep Kanban board**

- Navigation:** JIRA logo, Dashboards, Projects, Issues, Boards, Create button, Search bar, and utility icons.
- Board Title:** Design PDR Prep Kanban board.
- Quick Filters:** Only My Issues, Recently Updated.
- Columns:**
  - 2 To Do**
  - 4 In Progress**
  - 50 Done**
  - Release...** link.

**Bottom Screenshot: DHCI board Akupara**

- Navigation:** Ensemble JIRA logo, Dashboards, Projects, Issues, Boards, Create button, Search bar, and utility icons.
- Board Title:** DHCI board Akupara.
- Quick Filters:** Only My Issues, Recently Updated.
- Additional Info:** 7 days remaining, Complete Sprint.
- Columns:**
  - To Do:** Contains issue DHCI-478 with description: "Edward: As the HCI team, I have a research plan for user engagements at Goldstone".
  - In Progress:** Contains issue DHCI-446 with description: "As an HCI team member, I have a clear understanding of what it's like to run a track".
  - Done:** Contains issue DHCI-482 with description: "As the DSN Team, I'm confident that numbers are deployed in the best way because it's been tested".

Lessons Learned: Changing the way we work

# Constant PR

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Image credit: <http://openset.printedweb.org/>



# Workshop till you drop

SYSTEMS + PEOPLE TRAINING EVENT

MON JULY 25

HOW TO MAKE THE RIGHT THING  
PICKERING AUDITORIUM

**talks**

9AM - 10:15AM, Pickering Auditorium  
**Risks From Not Including People at Design Time (And How To Fix Them)**  
Guy Andriy Bur  
Former KSC Chief Scientist  
INCISE Human Systems Integration Co-Chair

10:30AM - 11:30AM, Pickering Auditorium  
**The Social Nature of Systems Engineering Design: An Introduction**  
Steve Harrison  
Virginia Tech Human-Centered Design Director

11:45AM - 12:45PM, Pickering Auditorium  
**How Developing a Deep Understanding of the User Improves Productivity & Results**  
Alan Cooper  
Father of Visual Basic

**workshops**

1PM - 5PM, Bldg 321 Basement  
**How to Express Complex Ideas in Simple Ways Using Storytelling: Scenarios**  
Cooper Design

1PM - 5PM, Bldg 321 Basement  
**Can Early Participation of End-Users Mitigate Systems Engineering Risks?**  
Guy Boy, Steve Harrison  
INCISE Human-Systems Integration Chair  
Virginia Tech Human-Centered Design Director

1:15PM - 2:15PM, Bldg 321 Basement  
**Make / Buy / Free - Effects On Innovation & Design**  
Brent McWaters

2:30PM-5PM, B321 Basement  
**The Journey is the Destination: How an Iterative Approach to Software Development Results in Better User Experiences**  
Michael McWaters  
TED UX Architect

On lab or VPN: [hi.jpl.nasa.gov/systemsandpeople](http://hi.jpl.nasa.gov/systemsandpeople)




397F | Human Centered Design Group &  
11x | Human Resources Directorate

**WHAT'S MISSING FROM YOUR TRADE STUDY?**  
SOLVING WICKED PROBLEMS WITH DESIGN THINKING

TALKS + WORKSHOPS  
AUGUST 29 + 30

Register on the Guidebook App  
-or-  
[guidebook.com](http://guidebook.com)



Phrases:  
**designthinking2017**

How does your team...

- See whole systems?
- Find novel answers?
- Prioritize requirements?
- Predict human behavior?
- Manage process change risk?

**Dana Newman**  
Former Deputy Administrator  
NASA  
Apollo Professor of Astronautics  
MIT

**Shel Kamen**  
Global User Experience  
Practice Manager  
Ford Motor Company

**Tatyana Mamut**  
General Manager  
Director of Product  
Amazon Web Services

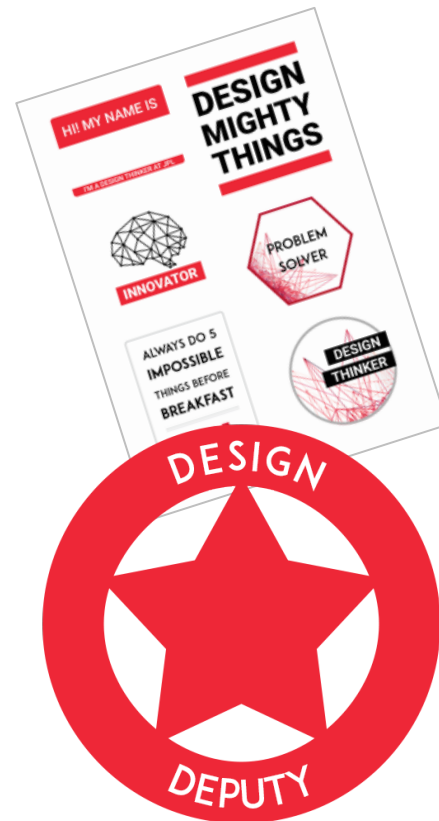
**Erin Murphy**  
User Interface Design Lead  
Mars 2020 JPL

**Jonathan Grudin**  
Principal Researcher with the  
Natural Interaction Group  
Microsoft Research

**Margot Dear**  
Senior Director of User Experience  
ADP

JPL

Please provide comments or questions to [designthinking@jpl.nasa.gov](mailto:designthinking@jpl.nasa.gov)



# Open door policy

What is C?  
Why C?  
How (approach)  
↳ When

## Video Structure

SE Pain (what)

CAESAR is answer (what)

How (approach) ←

René's vision ← ?

Talk to:

- ☐ Dave Nichols
- ☐ René

Flexible  
Extensible  
Integrated  
Connected  
Porous

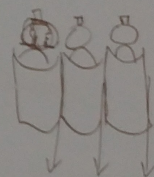
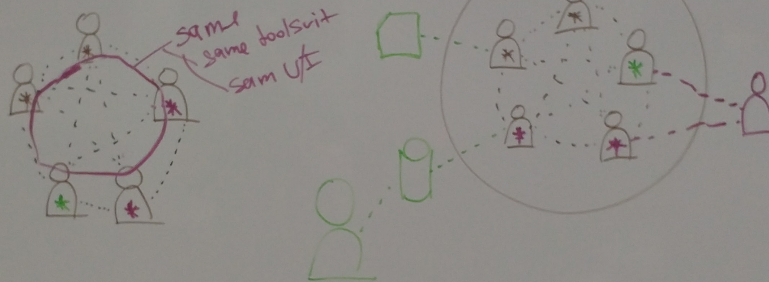
} Modular

CAESAR

## Analogies

Atoms

## Roman Army



FSDesign  
Problems

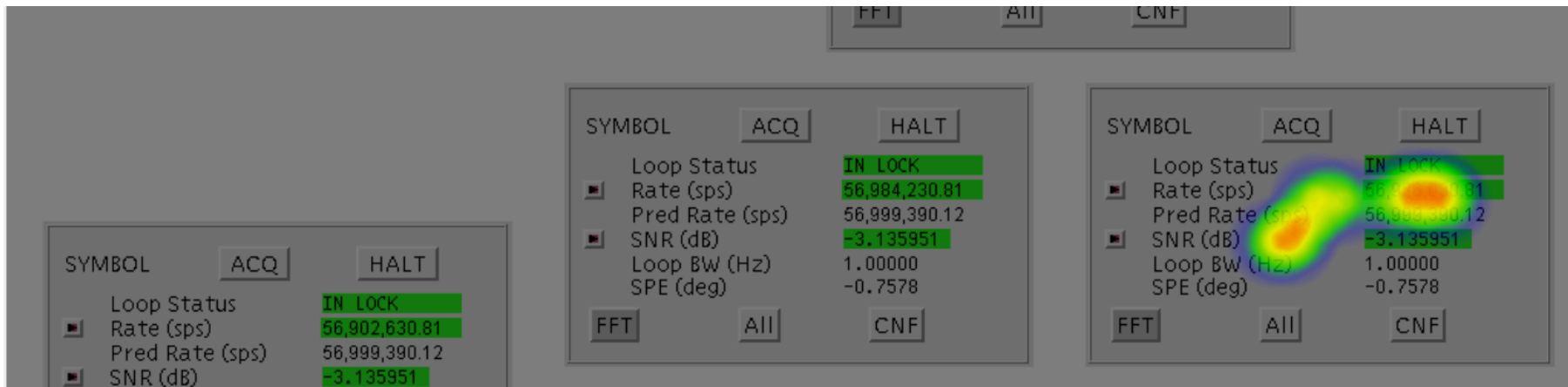
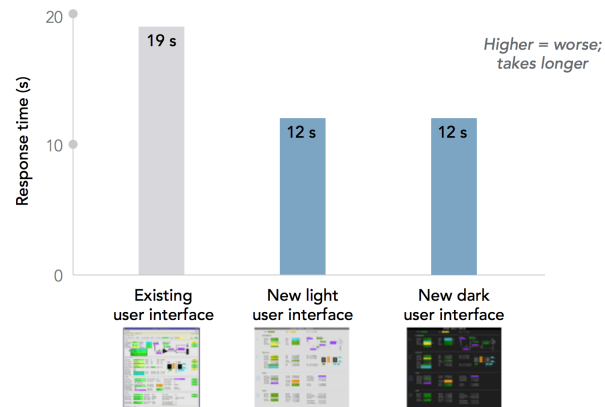
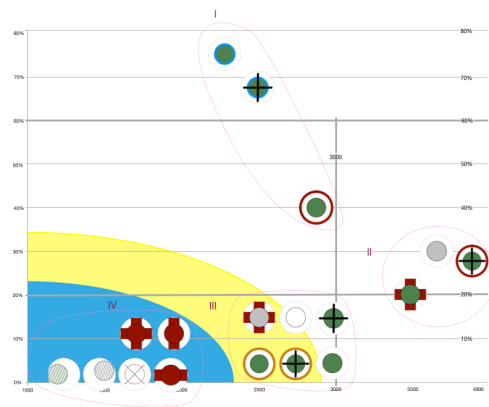


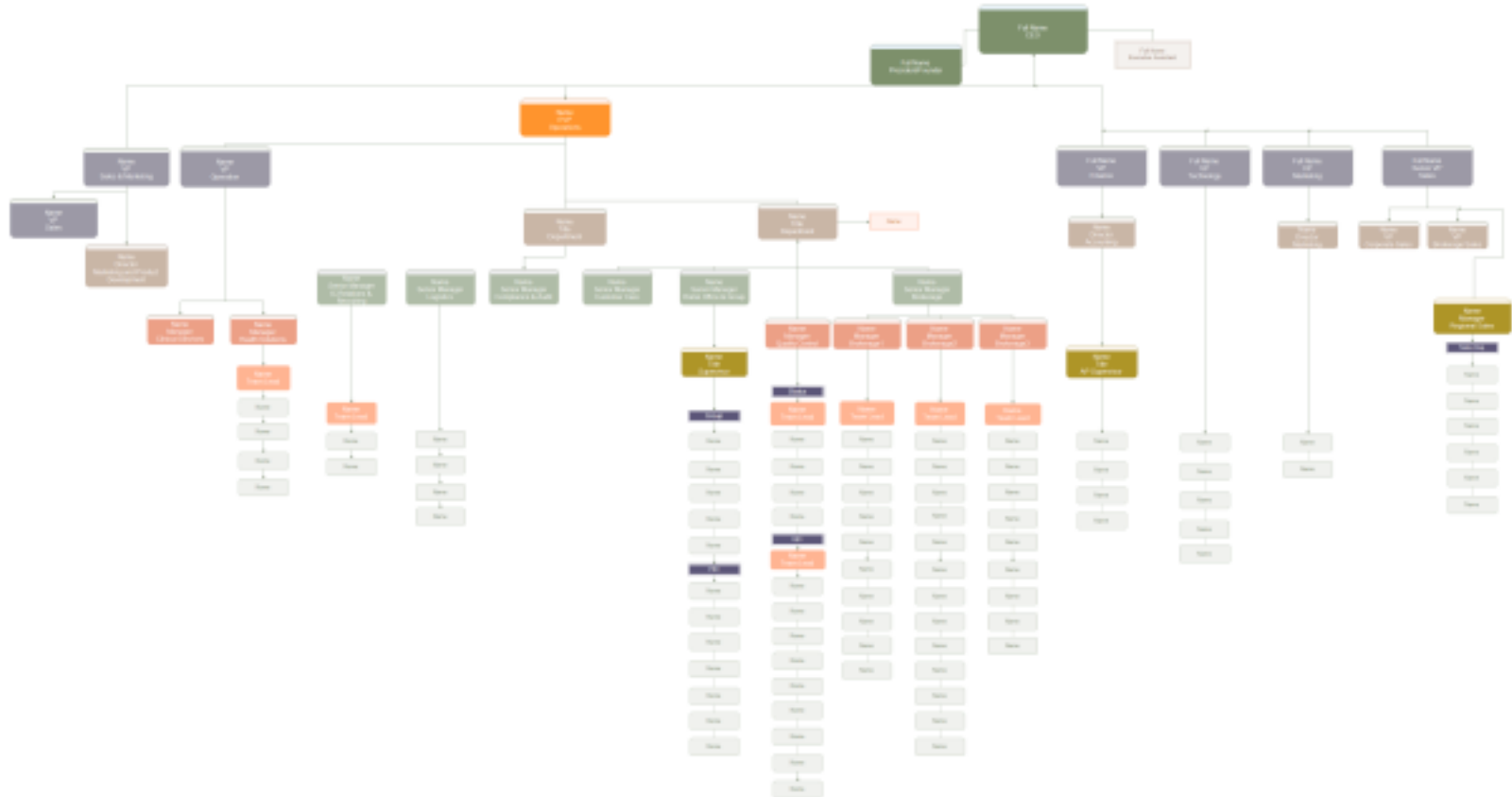
# Recruit evangelists



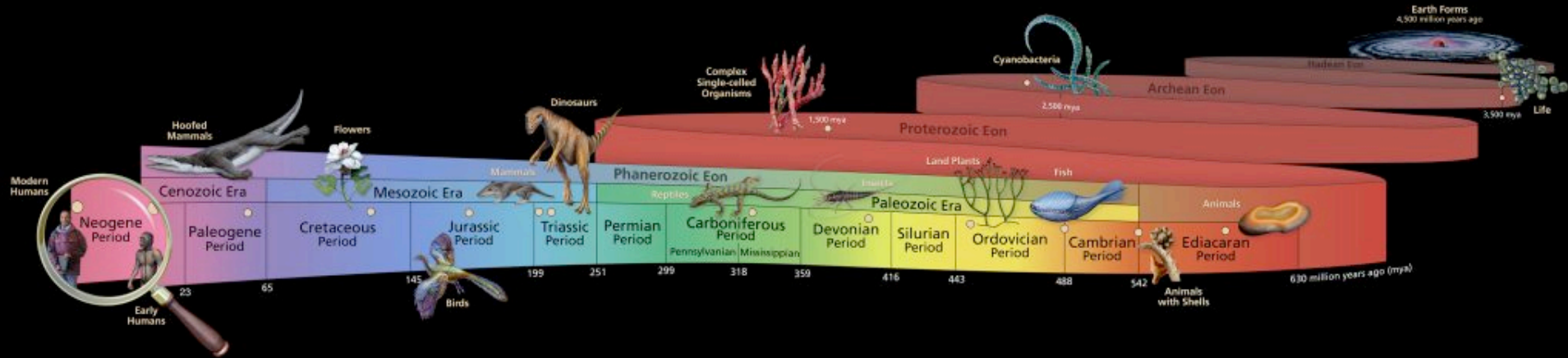


# Use data, not opinions





# Give it time





# Thank you!

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## Want More?

JPL Missions:

<https://www.jpl.nasa.gov/missions/>

Human Interfaces Group:

[hi.jpl.nasa.gov](https://hi.jpl.nasa.gov)

